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18. Diffuse band, generally faint, with absorption across middle at times.

19. Strong band with middle point at 6295Å, edges sharpening at intervals, particularly on August 3. Core always bright, 18Å wide, not always sharp-edged, and not (on August 3) central with the apparent limits of the band.

20. These features, frequently diffuse, often appear as one broad band with narrow absorption across middle and wing sections on either side.

21. Apparently strong absorption, possibly space between two bands.

22. Probably a separate band, altho apparently without a central core, the left half being brighter than the right half.

23. Possibly center of ill-defined band (6419Å to 6494Å) with slightly bright core, apparent on early plates.

24. Later this portion appears as bright core with center at 6470Å.

25. This interval appears as a background for H α (6520Å to 6602Å), but is probably composed of a band whose center precedes H α and of a wing to H α on its redward side. At times absorption appears across the first part preceding the edge of H α band.

26. Helium band with absorption across middle, always faint.

G. F. PADDOCK.

November, 1918.

MOVEMENTS OF FOUR UNKNOWN LINES IN THE SPECTRUM OF NOVA AQUILAE, 1918.

Two pairs of unidentified absorption lines which appeared intermittently in the spectrum of *Nova Aquilae* have shown conspicuous changes of position or wave-length. In each pair the two lines have appeared and disappeared together, maintained equal intensities and practically constant distances apart, moved equal amounts at the same times, and in all respects have behaved like duplicates. There seems to be, however, no definite relation of the times of appearance or disappearance of the pairs to each other; but the pair whose greatest observed wave-lengths were 4061Å and 4068Å always appeared and disappeared simultaneously with the sharp and narrow absorption lines of hydrogen, while the pair whose greatest observed wave-lengths were 4560Å and 4576Å were in general present at the

times of appearance or disappearance of the other pair and the hydrogen lines, or in other words, the latter pair apparently occurred in connection with the conditions attending transition of the spectrum. When the latter pair was not seen, a band of absorption, 30 to 40 angstroms wide and of varying intensity, lay within the region 4540A to 4580A. During the absence of the former pair, a bright band 5 to 10 angstroms wide appeared in their place with center located within 1 or 2 angstroms of the recent mean position of the lines. The position of this bright band has varied less than 4 angstroms and there is no definite evidence that it is related in its origin to the pair of lines.

The first mentioned pair of lines first appeared on June 15 and their position of greatest wave-length (4061A and 4068A) occurred on June 16. From June 16 to June 25 they gradually shifted toward the violet to 4054A and 4059A and disappeared. On July 1 they reappeared with a displacement of 21 angstroms, which decreased to 4 angstroms on July 3, and then increased to 10 angstroms on July 7, when they again disappeared. They made a sudden strong reappearance on July 14 to 16, but not again thereafter. Their sudden and intense recurrence on July 2 and 14 cannot help but give the impression of a tremendously energized event at their source.

The second mentioned pair of lines have been visible during intervals of only 2 to 4 days. They first showed faintly on June 30 and on July 1 stood at their positions of smallest wave-length, 4545A and 4561A. Their succeeding wave-lengths increased to 4560A and 4576A on July 16 and then decreased to 4549A and 4564A, which are approximately the same as those of their earliest appearance. They thus seem to have shifted toward the red, in opposite direction to the movement of the other pair, but the direction of shift cannot be stated without establishing their normal places or wave-lengths, which is impossible here.

Corresponding to the great displacement of the first pair on July 1, it is found that the second pair present their farthest position toward the violet on the same date. Aside from these extreme positions, which occurred abruptly, briefly, and but once, the displacements have amounted to 10 and 12 angstroms respectively for the two pairs of lines. The distance between the two lines of the first pair has ranged from 5 to 7 angstroms and that of the second pair 14 to 17 angstroms. These variations are probably

due to changing widths and appearances, and it is very probable that the lines possess a constant difference of wave-length.

Date, 1918	Displace- ments		Description	Displace- ments		Description
	From 4061A	From 4068A		From 4560A	From 4576A	
June 15	- 2A	- 4A	Diffuse	A	A	
16	0	0	"			
18	- 2	- 3	"			
19	- 2	- 2	"			
20	- 2	- 3	Fair			
21	- 3	- 4	"			
22	- 4	- 4	"			
23	- 6	- 7	Diffuse			
24	- 4	- 4	Fair			
25	- 7	- 9	Good			
26	- 6					
27	- 6					
28	- 6		Center of			
29	- 6		bright band			
30				- 12	- 12	Faint
July 1	- 21	- 21	Fair	- 15	- 15	Diffuse
2	- 8	- 8	Strong, wide			
3	- 4	- 5	"			
4	- 5	- 6	"			Absorption
5	- 6	- 7	Fairly sharp			band
6	- 7	- 8	Sharp			
7	- 9	- 10	"	- 4	- 2	Fair
9	- 4			- 6	- 6	Fair
10	- 4		Center of			Absorption
12	- 3		bright band			band
14	- 9	- 10	Sharp	- 3	- 2	Sharp
16	- 8	- 8	Sharp, strong	0	0	Sharp, strong
18	- 5			- 6	- 6	Fair, strong
19	- 4					
21	- 4					Absorption
23	- 5					band
25	- 4		Center of	- 8	- 7	Fair
28	- 6		bright band	- 11	- 13	Faint
Aug. 5	- 4					Absorption band
8	- 7			- 11	- 12	Faint
11	- 4					

The accompanying table contains approximate measures of the displacements of the lines toward the violet from their positions of greatest observed wave-lengths, together with their dates and brief

descriptions, from which the progressive and sudden shiftings of the lines and the relative times of their occurrence can easily be seen.

G. F. PADDOCK.

January, 1919.

HISTORICAL LETTER RELATING TO THE 36-INCH TELESCOPE

Mr. Ambrose Swasey has courteously given us permission to publish the following letter which we believe will be of interest to all members of our Society.—PUBL. COM.

July 31, 1896.

MR. J. F. HOLLOWAY,
Buffalo, New York.

DEAR FRIEND HOLLOWAY: Thinking it may be of interest to my friends I will relate some of the incidents that occurred during the time I was engaged in the erection of the Lick Telescope.

In the fall of 1887, the instrument was shipped to San Jose, California, and conveyed by team to the observatory on Mount Hamilton, which is about 4500 feet high¹ and thirteen miles distant in direct line and twenty-seven miles by road. The people of San Jose took great interest in everything that pertained to the Lick Observatory, and were especially interested in the powerful instrument that was to be placed in the great dome, which could be clearly seen from any part of the city. Every one having anything to do with the observatory or its instruments received special attention, and I was often smilingly met by "Good-morning, Professor Swasey"—thinking of course that was the proper title to give one engaged in the construction of astronomical instruments.

The great sections of the telescope, weighing several tons, were loaded on trucks drawn by six or eight unfortunate beasts, sometimes called horses. There were usually two drivers—the duty of one being to hold the lines and ride, while the other walked along by the side of the animals, and pelted them with stones, when extra energy was needed to revive their spirits in climbing the many long and steep grades. When they arrived at the top of the mountain, one could easily imagine the poor creatures—nearly dead from exhaustion—saying to one another: "This may be all right for science, but it is mighty hard on horseflesh."

¹Later, the elevation of the marble floor of the observatory above mean-tide level was determined to be 4,209 feet.—PUBL. COM.